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COMO LAKE, WALWORTH COUNTY, WISCONSIN

Pacific Northwest Environmental Research Laboratory

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NATIONAL EUTROPHICATION SURVEY

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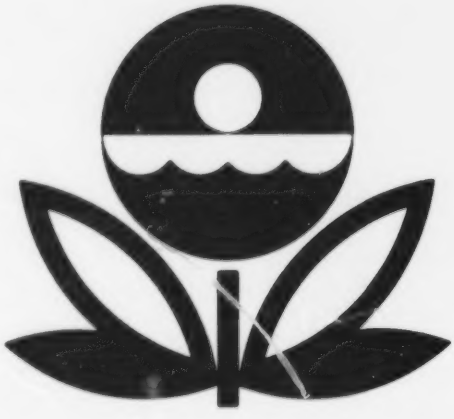

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

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REPORT

ON

COMO LAKE

WALWORTH COUNTY

WISCONSIN

EPA REGION V

WORKING PAPER No. 60

WITH THE COOPERATION OF THE

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

AND THE

WISCONSIN NATIONAL GUARD

JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS*

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

* The lake discussed in this report was included in the National Eutrophication Survey as a water body of interest to the Wisconsin Department of Natural Resources. Tributaries and nutrient sources were not sampled, and this report relates only to the data obtained from lake sampling.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wisconsin Department of Natural Resources for professional involvement and to the Wisconsin National Guard for conduct of the tributary sampling phase of the Survey.

Francis H. Schraufnagel, Acting Assistant Director, and Joseph R. Ball of the Bureau of Water Quality, and Donald R. Winter, Lake Rehabilitation Program, provided invaluable lake documentation and counsel during the Survey. Central Office and District Office personnel of the Department of Natural Resources reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

Major General James J. Lison, Jr., the Adjutant General of Wisconsin, and Project Officer CW-4 Donald D. Erickson, who directed the volunteer efforts of the Wisconsin National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

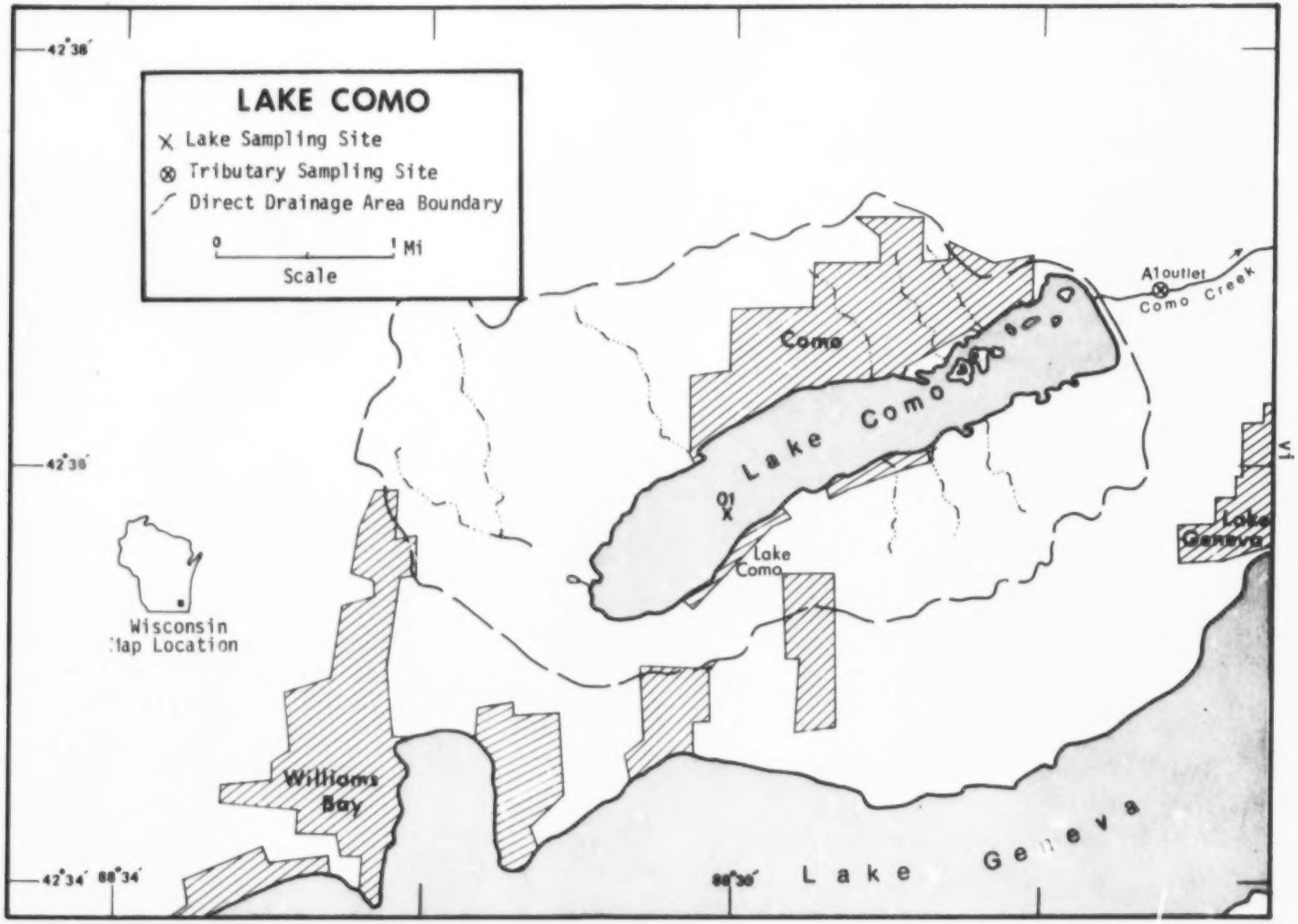
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF WISCONSIN

LAKE NAME	COUNTY
Altoona	Eau Claire
Beaver Dam	Barron
Beaver Dam	Dodge
Big Eau Pleine	Marathon
Browns	Racine
Butte des Morts	Winnebago
Butternut	Price, Ashland
Castle Rock Flowage	Juneau
Como	Walworth
Crystal	Vilas
Delavan	Walworth
Eau Claire	Eau Claire
Geneva	Walworth
Grand	Green Lake
Green	Green Lake
Kegonsa	Dane
Koshkonong	Jefferson, Rock, Dane
Lac La Belle	Waukesha
Middle	Walworth
Nagawicka	Waukesha
Oconomowoc	Waukesha
Okauchee	Waukesha
Petenwell Flowage	Juneau
Pewaukee	Waukesha
Pigeon	Waupaca
Pine	Waukesha
Poygan	Winnebago, Waushara
Rock	Jefferson
Rome Pond	Jefferson, Waukesha
Round	Waupaca
Shawano	Shawano

LAKE NAME	COUNTY
Sinnissippi	Dodge
Swan	Columbia
Tainter	Dunn
Tichigan	Racine
Townline	Oneida
Trout	Vilas
Wapogassett	Polk
Wausau	Marathon
Willow	Oneida
Winnebago	Winnebago, Fond Du Lac, Calumet
Wisconsin	Columbia
Wissota	Chippewa
Yellow	Burnett


LAKE COMO
Lake Sampling Site
Tributary Sampling Site
Direct Drainage Area Boundary
0
1 Mi
Scale
42°38'
42°36'
42°34'
88°34'
88°36'
A1 outlet
Como Creek
Como
Lake Como
Lake Como
Lake Geneva
Wisconsin
Map Location
Williams Bay
Lake Geneva

COMO LAKE

STORET NO. 5562

I. INTRODUCTION

Como Lake was included in the National Eutrophication Survey as a water body of interest to the Wisconsin Department of Natural Resources. No wastewater treatment plants impact the lake; and, other than the lake, only the outlet stream was sampled (Appendix C). Therefore, this report is concerned only with the lake sampling data.

II. CONCLUSIONS

A. Trophic Condition:

Survey data, field observations, and other reports (Poff and Threinen, 1961; Poff et al., 1969) indicate that Como Lake is eutrophic. Of the 46 Wisconsin lakes studied, 19 had less mean total phosphorus, 11 had less mean dissolved phosphorus, 35 had less mean inorganic nitrogen, 42 had greater mean Secchi disc transparency, and 36 had less mean chlorophyll a.

Survey limnologists observed algal blooms in August and November, 1972.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Como Lake was phosphorus limited at the time the sample was taken (11/10/72). The lake data indicate phosphorus limitation in August as well but nitrogen limitation in June.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 946 acres.
2. Mean depth: 4.3 feet.
3. Maximum depth: 9 feet.
4. Volume: 4,033 acre-feet.
5. Mean hydraulic retention time: 1.1 years.

B. Outlet:
(See Appendix A for flow data)

Name	Drainage area*	Mean flow*
Como Creek	9.1 mi^2**	5.3 cfs

C. Precipitation***:

1. Year of sampling: 38.7 inches.
2. Mean annual: 30.7 inches.

† Poff et al., 1969.
* Drainage areas are accurate within ±0.5%; mean daily flows are accurate within ±40%; mean monthly flows are accurate within ±35%; and normalized monthly flows are accurate within ±35%.
** Includes area of lake.
*** See Working Paper No. 1, "Survey Methods, 1972".

IV. LAKE WATER QUALITY SUMMARY

Como Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from one or more depths at a single station on the lake (see map, page vi). During each visit, a single depth-integrated (near bottom to surface) sample was collected for phytoplankton identification and enumeration; and a similar sample was collected for chlorophyll *a* analysis. During the last visit, a single five-gallon depth-integrated sample was taken for algal assays. The maximum depth sampled was 6 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

FALL VALUES

(11/10/72)

Parameter	Minimum	Mean	Median	Maximum
Temperature (Cent.)	6.5	(single measurement)		
Dissolved oxygen (mg/l)	10.3	(single measurement)		
Conductivity (μmhos)	450	450	450	450
pH (units)	8.3	8.3	8.3	8.3
Alkalinity (mg/l)	187	188	188	188
Total P (mg/l)	0.034	0.034	0.034	0.034
Dissolved P (mg/l)	0.009	0.010	0.010	0.012
NO_2 + NO_3 (mg/l)	0.140	0.155	0.155	0.170
Ammonia (mg/l)	0.240	0.250	0.250	0.260

ALL VALUES

Secchi disc (inches)	12	20	16	33

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/21/72	1. Merismopedia	7,609
	2. Chroococcus	2,536
	3. Scenedesmus	2,283
	4. Cosmarium	1,956
	5. Anabaena	942
	Other genera	1,703
	Total	17,029
08/16/72	1. Merismopedia	12,703
	2. Chroococcus	8,558
	3. Anabaena	3,964
	4. Lyngbya	3,964
	5. Scenedesmus	3,243
	Other genera	6,307
	Total	38,739
11/10/72	1. Microcystis	26,847
	2. Lyngbya	5,676
	3. Synedra	2,342
	4. Aphanocapsa	1,892
	5. Scenedesmus	631
	Other genera	1,891
	Total	39,279

2. Chlorophyll *a* -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
06/21/72	01	54.4
08/16/72	01	29.1
11/10/72	01	25.7

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.007	0.212	0.3
0.006 P	0.013	0.212	1.4
0.012 P	0.019	0.212	3.7
0.024 P	0.031	0.212	7.0
0.060 P	0.067	0.212	7.8
0.060 P + 10.0 N	0.067	10.212	21.9
10.0 N	0.007	10.212	0.3

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential primary productivity of Como Lake was relatively low at the time the sample was taken (11/10/72). Also, the increased yields with increased levels of orthophosphate show that the lake was phosphorus limited at that time (note the lack of yield response when only nitrogen was added).

The lake data indicate phosphorus limitation in August as well (N/P = 52/1) but nitrogen limitation in June (N/P = 6/1).

V. LITERATURE REVIEWED

McElwee, William D., 1972. Personal communication (excerpts from "A comprehensive plan for the Fox River watershed"). SE Wisc. Reg. Planning Comm., Waukesha.

McKersie, Jerome R., Robert M. Krill, Bernard G. Schultz, and Terry A. Moe; 1972. Fox (Illinois) River pollution investigation survey. WI Dept. Nat. Resources, Madison.

Poff, Ronald, C. W. Threinen, Donald Mraz, Wilbur Byam, Ronald Piening, Brian Belonger, Warren Churchill, and D. John O'Donnell; 1969. Como Lake, an inventory with planning recommendations. Lake Use Rept. No. FX-4, WI Dept. Nat. Resources, Madison.

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TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5562 LAKE COMO

TOTAL DRAINAGE AREA OF LAKE 9.06

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5562A1	9.06	3.50	4.20	10.00	8.90	6.20	8.60	3.90	3.10	3.90	3.90	4.60	3.30	5.34
5562ZZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 9.06
SUM OF SUB-DRAINAGE AREAS = 0.0
TOTAL FLOW IN = 0.0
TOTAL FLOW OUT = 64.10

NOTE *** NO INLET STREAMS

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5562A1	9	72	15.00	23	22.00				
	10	72	10.00	20	5.80				
	11	72	7.70	29	5.10				
	12	72	5.10	27	4.10				
	1	73	7.90	29	6.60				
	2	73	6.00	24	3.60				
	3	73	19.00	20	17.00				
	4	73	56.00	14	38.00	30	58.00		
	5	73	19.00	17	13.00	26	13.00		
	6	73	8.00	22	7.60				
	7	73	2.10	22	1.90				
	8	73	1.20	24	1.20				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/09/30

556201
42 35 42.0 088 30 12.0
LAKE COMO
55 WISCONSIN

11EPALES
3

2111202
0010 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/21	19 10 0000		21.3	9.4	12	335	8.60	162	0.080	0.100	0.074	0.030
72/08/16	18 00 0000				16	380	8.40	149	0.260	0.270	0.047	0.010
	18 00 0004		24.3	9.2		370	8.50	148	0.330	0.300	0.049	0.012
	18 00 0006		24.3	8.8		355	8.50	145	0.370	0.350	0.147	0.015
72/11/10	10 05 0000				33	450	8.30	188	0.140	0.240	0.034	0.009
	10 05 0004		6.5	10.3		450	8.30	187	0.170	0.260	0.034	0.012

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/21	19 10 0000		54.4J
72/08/16	18 00 0000		29.1J
72/11/10	10 05 0000		25.7J

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/10/02

5562A1 LS5562A1
42 37 00.0 088 27 30.0
COMO CREEK
55 15 LAKE GENEVA
0/LAKE COMO
US 12 XING .5 MI E OF COMO
11FPALES 2111204
* 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	08	15	0.165	1.000	0.161	0.020	0.115
72/10/20	17	30	0.035	1.470	0.117	0.018	0.060
72/11/29	15	20	0.045	0.942	0.115	0.005K	0.037
72/12/27	09	05	0.044	1.000	0.016	0.005K	0.032
73/01/29	15	50	0.176	0.960	0.069	0.014	0.050
73/02/24	12	30	0.052	1.000	0.078	0.005K	0.020
73/03/20	11	30	0.021	0.920	0.031	0.005K	0.195
73/04/14	14	00			0.056	0.075	
73/04/30	15	35	0.040	0.780	0.035	0.011	0.070
73/05/17	17	00	0.070	1.150	0.025	0.010	0.045
73/05/28	12	30	0.068	1.200	0.034	0.022	0.065
73/06/22	14	30	0.024	1.100	0.048	0.030	0.090
73/07/22	12	35	0.034	1.300	0.012	0.010	0.085
73/09/24	09	00	0.310	2.300	0.710	0.052	0.155

K VALUE KNOWN TO BE LESS
THAN INDICATED